Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	Proceeding No. RM11681
Updated Comments on Ligado's	)	
Request to Use 1675-1680MHz	)	

Comments

The FCC has requested that the comments regarding Ligado's use of spectrum between 1675 MHz and 1680 MHz for terrestrial cellular service be updated. I submitted comments in the summer of 2015[1] and would like to provide the following updated comments regarding the University of North Florida's (UNF) use of the National Oceanic and Atmospheric Administration (NOAA) Geostationary Operational Environmental Satellite (GOES) services at or near the spectrum between 1675 MHz and 1680 MHz. I oppose the shared use of the 1675 MHz to 1680 MHz spectrum by terrestrial cellular service providers.

To support communications research, provide a learning opportunity for engineering students, and foster interest in Science, Technology, Engineering, and Mathematics (STEM) through outreach among visiting K-12 students at the School of Engineering at UNF, two earth stations that will receive L-Band products from the current GOES and the planned GOES-R satellites are being deployed. The build-out plans include the reception of the GOES Data Collection System (DCS) downlink service on both the current GOES and planned GOES R satellites, the reception of Low Rate Information Transmission (LRIT) and separate Emergency Managers Weather Information Network (EMWIN) service on the current GOES satellites, and the reception of the combination High Rate Information Transmission (HRIT) and EMWIN service planned for GOES R satellites.

These products will be used for several research projects. The reception of the GOES DCS downlink product will allow researchers at UNF to study occasional anomalies in the signal and help develop mitigation strategies. The reception of the LRIT and combined HRIT/EMWIN signals will allow UNF to research radio technology solutions for improved receiver designs for those signals. These projects require the use of the GOES L-Band downlink itself and alternative solutions including DOMSAT, NOAAport, and the internet will not meet the needs of these types of research projects.

Once installed, UNF engineering and science students will assist in the operation of the earth stations. This will enhance the student's exposure to areas of study including satellite communications and the environmental sciences. In addition, in support of UNF's efforts to promote STEM, visiting K-12 students will be invited to examine the equipment and the environmental data products that can be received. Hands-on experiences such as this are critical to the promotion of STEM.

[1] Comments submitted in Docket 12-340 by Brian Kopp on June 28, 2015

In November 2015, Ligado submitted comments on the non-federal use of NOAA GOES downlink products[2]. They suggested that earth station receiver sites for research should be limited to co-location at NOAA facilities[3]. There are numerous reasons why this suggestion is problematic. First, NOAA may not permit the co-location for any number of reasons. Second, the cost of installing and operating a NOAA-approved research earth station receiver site will be greater than that of an installation at the researcher's university. Further, an installation at a NOAA facility will preclude most if not all efforts for use of the earth station receiver as a teaching aid and STEM promotional tool.

The earth station receiver equipment that will be installed at UNF involves the use of high-gain parabolic dish antennas and industry standard L-Band feedhorn and downconverter assemblies. Depending on the project the two station antennas may be pointed at either the GOES-east or GOES west satellites. The antennas will be mounted on the roof of the UNF Engineering Building at an elevation of approximately 50 feet above ground level. As needed, any necessary changes will be made to migrate the earth station receivers to the new downlink frequencies that GOES-R will use. It is believed the frontend of industry standard feedhorn-downconverters is sufficiently wide to permit this spectrum shift – a beneficial feature for us that may well be particularly problematic for sharing spectrum with terrestrial cellular services that cause adjacent channel interference.

With regard to sharing the spectrum with terrestrial cellular services, I am very concerned about the possibility of harmful interference jeopardizing the integrity of the planned earth station receivers. Recalling the difficulties Lightsquared (Ligado's predecessor) encountered with the GPS industry, the earth station receivers that use L-Band GOES downlink services, including DCS, EMWIN, LRIT, and the GOES Variable (GVAR) data service on the current GOES satellites, and DCS, HRIT/EMWIN, and the GOES Rebroadcast (GRB) service on the planned GOES R satellite are all using receiver and antenna technology that assumes no significant co-channel or adjacent spectrum interference. This was a significant issue for the receiver equipment used in the GPS industry.

In addition, the build-out of cellular networks is typically not shared with the public. An earth station receiver owner may have no way of knowing that a cellular base station was deployed nearby and is causing their receive system to fail. It may take multiple service calls and a significant amount of time and money to determine the cause of the interference. Even then if the cellular service were co-primary, the earth station owner must bear some of the costs, if not all, for interference mitigation to their station. Universities, or for example county emergency operation centers using EMWIN, who operate a GOES earth station receiver bought with a grant, may not be able to afford to pay for the mitigation. Similarly, the cellular service provider may have no way of knowing where a GOES receiver earth station is located as they build out their system. Neither the NTIA nor the FCC currently track GOES earth station receiver sites. A new cellular service installation may be deployed right next to a receiver earth station, and the error only discovered after the cellular site turn-up and the resulting failure of the nearby earth station.

The scenario for new GOES earth station receiver sites that are deployed after a cellular service provider completes his build-out is also problematic. The earth station user may not find out until after they have

[2] Report submitted in Docket 12-340 by Lightsquared, LLC, submitted November 5, 2015, entitled "Assessment of the 1675-1680 MHz Band, Spectrum Sharing Between NOAA and Commercial Wireless Network, Preservation of NOAA Functional Requirements, Continued Provision of Data Products and Services to Non-NOAA End-Users."
[3] Ibid., page 20.

spent perhaps tens of thousands of dollars on an earth station, that there is a significant interference problem at that location.

Complicating these scenarios further, the anticipated planned use of LTE by cellular service providers will result in continuing modifications to the protocols being used for transmissions, as upgrades are deployed. Build-out site densities in some areas will be modified over time as well. These changes may result in a configuration that causes interference to an existing GOES earth station receiver site where no interference was detected before.

Interference to an earth station may also impact the receiver earth station link margin without causing an immediate obvious failure. A minor future change in the link configuration, perhaps even normal aging of equipment, may then cause a failure to occur. The integrity of the link was previously compromised by the interferer and not the minor change. Had the interference not been there, the receiver earth station link margin that was designed for originally would have absorbed the effect of the minor change. The cost of mitigating such a failure would be very difficult to assign to the interferer.

These issues are problematic for all of the GOES earth station receiver products but they are particularly impactful on DCS. The DCS downlink will overlap the 1675 MHz to 1680 MHz spectrum once GOES-R is online. Interference to this service will be most severe since the interference may be co-channel. Where direct reception of the DCS downlink is necessary for research or for mission critical reasons as others have suggested[4], there is no alternative.

Despite these concerns and objections to sharing the spectrum, should the FCC permit the proposed changes to the spectrum then the terrestrial cellular service providers must be afforded secondary status so that cellular service providers will be responsible for mitigating any interference caused to current and future earth station receiver installations. If this is not done, then the future usefulness of the NOAA GOES platform will likely be jeopardized. New and useful applications in environmental monitoring that might have been developed that require direct reception of data from GOES will be less likely to be advanced. In addition, to the extent that such applications are in support of the world's response to global warming, the reduction in utility of this service may actually contribute to a negative impact on the environment.

If the FCC elects to reallocate 1675-1680 MHz for terrestrial mobile service downlink use, as Ligado has requested, the FCC will need to apply a philosophy for managing communication sites that includes earth station receivers. To protect all NOAA GOES earth station receivers, the FCC should establish a receiver interference protection policy for this spectrum and include the following features at a minimum:

- Assign secondary status for terrestrial mobile downlink transmitters. The burden of interference mitigation is then on the mobile service provider who presumably has the knowledge, resources, and capabilities to address such issues. Terrestrial mobile service providers would be required to mitigate or terminate operation of any fixed downlink transmitter(s) that causes interference to a current or future earth station operated by an authorized NOAA GOES user (federal or non-federal). The language in the Code of Federal Regulations (CFR) Title 47, Part 27.1135, which provides protection to non-federal government meteorological satellite earth receivers operating between 1675 and 1710 MHz, from Advanced Wireless Service (AWS) licensees operating in the 1710-1755 MHz band,

[4] FDOT comments filed in Docket 12-340, February 6, 2015.

should serve as a model for new rules regarding secondary status for terrestrial mobile downlink transmitters at 1675-1680 MHz.

- Establish safe-harbor (protection zone) criteria that would prevent a terrestrial mobile service provider from constructing a downlink transmitter site near any existing earth station operated by an authorized NOAA GOES user without coordinating with them to avoid interference. In addition, require the terrestrial mobile service providers to reevaluate this criteria, and report any impact to the FCC, when the technical specifications for their service are to be changed, e.g. the deployment of a new release of the LTE protocol by the 3GPP.

- Establish a volunteer public database that documents current and future earth stations, deployed by authorized users, to communicate with the GOES satellite. This database could support all GOES downlink products and their users.

- Establish a required public database that lists the locations of all terrestrial fixed transmitters sharing the band. A public database permits current and future earth station users to contact terrestrial operates for interference mitigation.

- Require the cellular service provider to pay an administrative interference remediation fee to the FCC should they cause interference to an earth station receiver previously documented in the database.

There is precedence for the FCC to maintain a volunteer public database of receive-only earth stations associated with satellite communications in order to protect them from terrestrial interference. Currently, the FCC International Bureau Licensing System (IBLS)[5] maintains a volunteer database of receive-only earth stations associated with satellite communications,[6] in particular television receive-only earth stations. Under this program, an earth station operator who registers with the IBLS is protected from interference caused by licensed terrestrial microwave. A very similar database configuration could be used to protect the earth stations of authorized NOAA GOES users from the terrestrial interference that will be created by a system such as Ligado's, should they be allowed to share the spectrum.

Should you have any further questions regarding these comments please do not hesitate to contact me.

Regards,

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[5] http://transition.fcc.gov/ib/sd/se/elichome.html
[6] CFR Title 47, Part 25.131.